ALUMINUM

Project Fact Sheet

Molten Aluminum Treatment by Salt Fluxing

Benefits

- Reduce the energy needs of the U.S. aluminum industry by 150 billion Btu per year by the year 2008
- Reduce chlorine fluxing usage by approximately one million pounds per year
- Reduce carbon dioxide (greenhouse gas) by an estimated 1.24 pound per ton of aluminum produced per year
- Reduce industry-wide (domestic) carbon dioxide by approximately 18.6 million pounds per year by the year 2008
- Eliminate baghouse and wet scrubber technology for emission control and reduce its maintenance costs

Applications

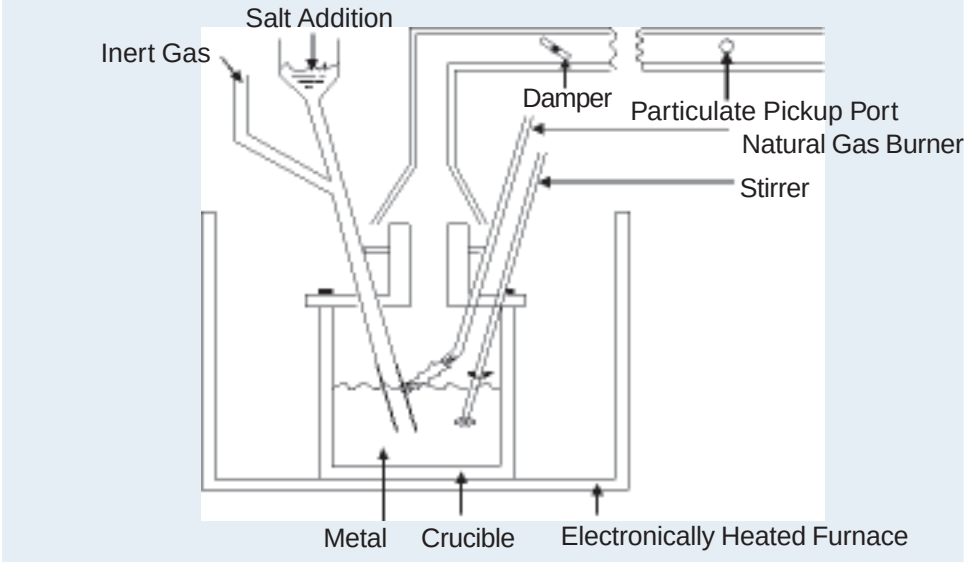
Given the strong industry involvement in the project, this research will benefit a large segment of the aluminum industry.

Molten Aluminum Treatment by Salt Fluxing with Low Environmental Emissions

Primary and secondary molten aluminum processing and refining involve fluxing metal with either pure chlorine gas or a mixture of chlorine and inert gas. The stack emissions caused by this gas injection include dust particles, hydrogen chloride, chlorine, and aluminum chloride gases. Recently, Secondary Aluminum Maximum Achievable Control Technology (MACT), under the Clean Air Act, has set tough new limits on particulate matter and total hydrogen chloride emissions from the furnaces. Additionally, chlorine gas is highly toxic and its handling, storage, and use pose risks.

This research will investigate, understand, and minimize the emissions resulting from solid chloride flux addition to molten metal for alkali impurity and non-metallic inclusion removal. Ohio State University will study the salt metal interactions and monitor the emissions at laboratory scale and Alcoa will verify the findings on commercial scale. The project's goal is to obtain a fundamental understanding, based on first principles, of the mechanisms for the pollutant formation that occurs when the salts are used in furnaces. This mechanistic information will be used to control process parameters so emissions are consistently below the required levels. The information obtained in these experiments will be used to develop mathematical models that will help optimize the process.

Laboratory Scale Experiment



Schematic of the laboratory scale experimental set-up.

Project Description

Goal: The project's goal is to minimize energy consumption by (1) optimizing the fluxing process, thereby reducing processing time; (2) improving metal quality, thereby reducing scrap and rework; and (3) eliminating or reducing the use of chlorine gas fluxing by substituting solid chloride salts.

Progress and Milestones

- Thermodynamically analyze all possible chemical reactions between various salt components and metal.
- Fabricate laboratory scale experimental setup at participating university.
- Conduct laboratory scale experiments focussing on holding furnace applications and melting experiments.
- Monitor particulate matter and gaseous emissions.
- Validate laboratory scale results with commercial scale experiments at industry partner site.
- Develop mathematical models based on the experimental and commercial scale results.

Commercialization Plan

The results of this research and development program, including the mathematical models developed, will be available in the open literature and will facilitate commercialization of the new optimized process on solid chloride salt fluxing of melt.

Project Partners

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